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Operational Manual

Frequency Extension for Noise Figure Analysers (FBC/WGNS)

QUALITY
ISO 9001:2015
NSAI Certified

1. Introduction

Thank you for choosing FBC Frequency Block Down-converter and WGNS Noise Source. This user manual provides all the information related to installation, operation and troubleshooting of your FBC & WGNS. In order to bring out the maximum performance, we advise that you read this user's manual before using these products for the first time and consult it later should such a need arise.

The FBC-XX and WGNS-XX families of Frequency Block Down-converter and Noise Sources modules, respectively, are used for extending the range of noise figure and spectrum/signal analyzers to frequencies ranging from 26.5 GHz to 170 GHz, in waveguide bands from WR-28 to WR-06. These modules offer a full band coverage, a very low system noise floor and a very high excess noise ratio (ENR), and provide a very accurate noise figure test solution. They come with dedicated AC/DC power supplies that provide the required voltage and meet the maximum current requirements of each module in the FBC/WGNS-XX family.

General Safety Precautions.
To prevent property damage and personal injury observe all instructions and warnings given in this manual as well as the manual of the DC power supply unit connected to FBC/WGNS-XX modules.

2. List of parts

2.1 Whats in the box

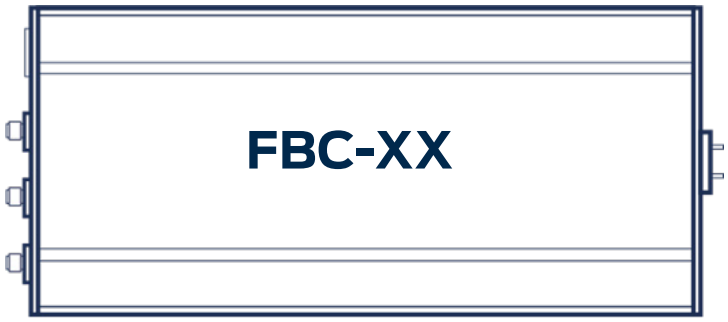
When you receive the FBC-XX block down-converter ad/or WGNS-XX noise source, please follow the steps below:

1. Unpack the FBC/WGNS-XX modules and other contents from the shipping box.
2. Retain the original packing material for use when transporting or shipping the product later.
3. Check the equipment for completeness. The shipment must include the following items listed on page 3.
4. Check the modules for damage, especially the test port adapters and test port flange surfaces.
5. Report any damages to the shipping company and retain the original packaging materials.

2.1 Whats in the box

This sub-section (page 3), introduces the various components and accessories that comes with the FBC/WGNS-XX modules. Be sure to familiarise yourself with them before using the system.

1x

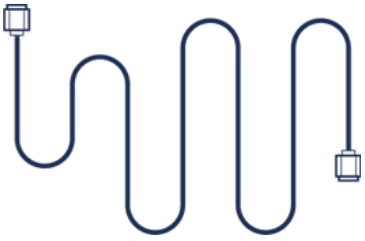


1x

1x

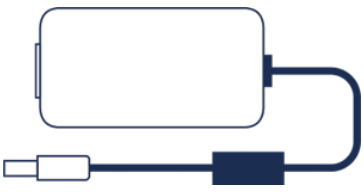
LO SMA Cable

1x



IF SMA Cable

1x



DC Power Supply

1x

Ruggedized Waveguide

1x

BNC Cable

6.2.2 FBC/WGNS-XX Measurement

FCB/WGNS-XX Measurement Setup

Noise figure measurement methods vary for different applications. Figure 2.1 depicts a standard measurement configuration comprising an FBC-XX down-converter, WGNS-XX noise source, Agilent N8973A NFA and E8247C signal generator. The N8973A NFA generates a 28 V DC pulse signal to drive the WG noise source, which, in turn, generates noise to stimulate the DUT. The output of the DUT is then measured by the N8973A NFA.

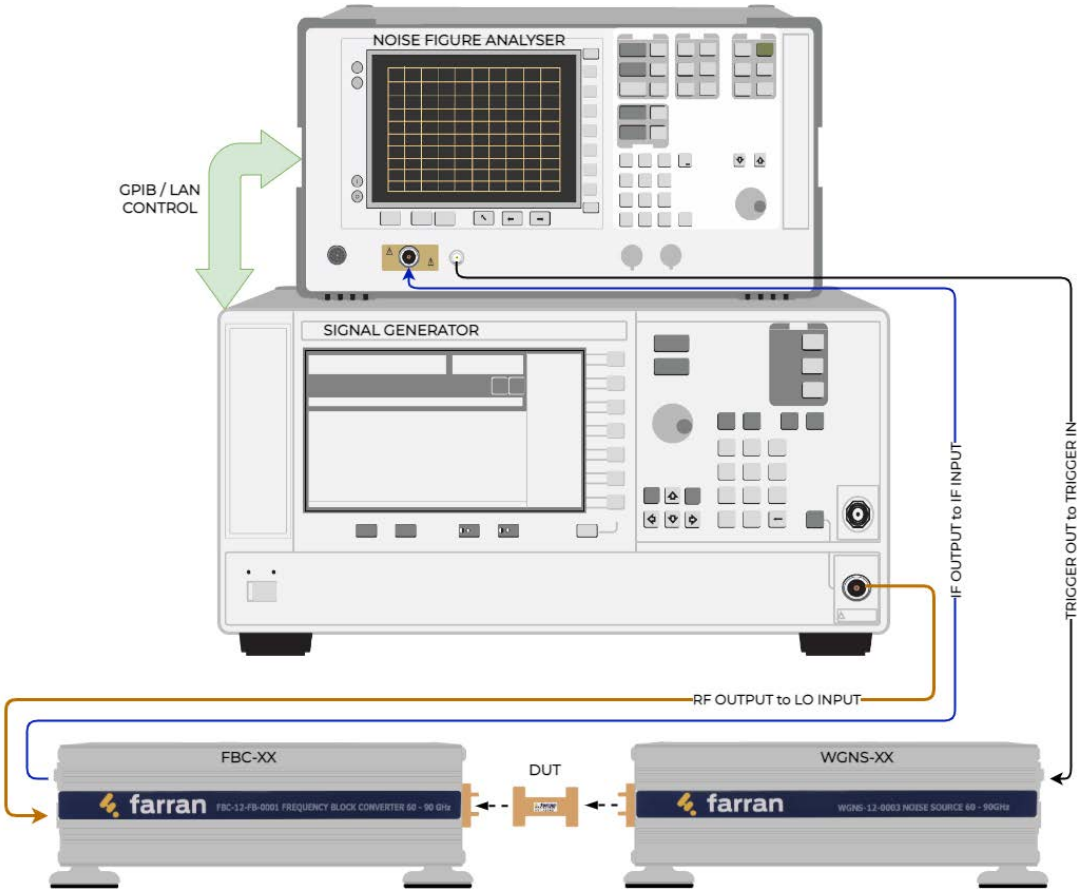


Figure 2.1: Typical Noise Figure Analyser measurement setup

The FBC/WGNS-XX solution is designed to be interfaced with customer owned Agilent NFA or Signal Analyser and Signal Generator.

Connection Steps

- Ensure the Noise source (WGNS-XX) and its power supply are connected correctly as per Fig. 2.1.
- Connect the FBC-XX (SMA-F) IF output to the N8975A 50Ω input (SMA-F) using the SMA cable provided.
- Connect the FBC-XX LO Input (SMA-F) to the E8247C output (SMA-F) using the SMA cable provided.
- Connect the N8975A to the E8247C LO GPIB port using a GPIB cable (not supplied).

FTL suggests using an industry standard 8in/lb torque wrench fortightening SMA and 3.5 mm connectors.

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7. Technical Specifications

7.1 FBC-XX Specifications

Table 1. FBC-XX Specifications

Model	Parameters															
	Operating Frequency (GHz)		System Conversion Gain (dB)	System Noise Figure (dB)		IF Output Frequency (MHz)			Test Port Damage Level (dBm)	LO Input Power (dBm)		IF/LO Connector	Power Requirements (V)	Wght. (kg)	Dim. (mm)	Test Port Interface
	min	max	min	typ	max	min	typ	max	min	min	max	typ	nom	typ	typ	typ
FBC-28-FB-0001	26.5	40	+10	15	18	4.5	-	18	+5	+5	+10	SMA 3.5 mm (F)	240/110 V AC	3.5	290x120x90	WR-28 UG-599/U
FBC-22-FB-0001	36.5	50	+10	11	15	4.5	-	18	+5	+5	+10	SMA 3.5 mm (F)	240/110 V AC	3.5	290x120x90	WR-22, UG-383/U
FBC-15-FB-0001	50	75	+10	10	13	-	11.139	-	+5	+5	+10	SMA 3.5 mm (F)	240/110 V AC	3.5	290x120x90	WR-15, UG-383/U
FBC-12-FB-0001	60	90	+10	14	17	-	11.139	-	+5	+5	+10	SMA 3.5 mm (F)	240/110 V AC	3.5	290x120x90	WR-12, UG-387/U
FBC-10-FB-0001	75	110	+10	12	15	-	11.139	-	+5	+5	+10	SMA 3.5 mm (F)	240/110 V AC	3.5	290x120x90	WR-10, UG-387/U-M
FBC-06-FB-0001	110	170	+10	18	20	-	11.139	-	+5	+5	+10	SMA 3.5 mm (F)	240/110 V AC	3.5	290x120x90	WR-06, UG-387/U-M

Specification Definitions

Nominal value (nom.) – ensured by design, not tested. **Measured value (min, max)** – expected and warranted product performance obtained from the actual measurements of product sample. **Non-traceable measured value (n. trc. meas.)** – expected product performance obtained from the actual measurements of a product sample by means of using Farran's own equipment and methods. Traceable only to Farran laboratory equipment. **Typical data (typ.)** – value that represents the product specification met over 90% of bandwidth or a mean value. **Specifications without limits** – represent the warranted product performance; with values of no or a negligible deviation from the given value and as such have a secondary impact on the product performance.

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7. Technical Specifications

7.2 WGNS-XX Specifications

Table 2. WGNS-XX Specifications

Model	Parameters										
	Operating Frequency (GHz)		ENR (dB)	Pause Between Trigerring Pulses (ms)	Trigger Voltage (V)	VSWR	Triggering Connector	Power Requirements (V)	Wght. (kg)	Dim. (mm)	Test Port Interface
	min	max	min	min	min	min	typ	nom	typ	typ	typ
WGNS-28-0003	26.5	40	14.5	0.5	+28	1.4:1	BNC (F)	240/110 V AC	3.5	200x120x90	WR-28 UG-599/U-M
WGNS-22-0003	36.5	50	13.5	0.5	+28	1.4:1	BNC (F)	240/110 V AC	3.5	200x120x90	WR-22, UG-383/U-M
WGNS-19-0003	40	60	12.5	0.5	+28	1.4:1	BNC (F)	240/110 V AC	3.5	200x120x90	WR-19, UG-383/U-M
WGNS-15-0003	50	75	11.5	0.5	+28	1.4:1	BNC (F)	240/110 V AC	3.5	200x120x90	WR-15, UG-387/U-M
WGNS-12-0003	60	90	11.5	0.5	+28	1.4:1	BNC (F)	240/110 V AC	3.5	200x120x90	WR-12, UG-387/U-M
WGNS-10-0003	75	110	11.5	0.5	+28	1.4:1	BNC (F)	240/110 V AC	3.5	200x120x90	WR-10, UG-387/U-M
WGNS-06-0003	110	170	11.5	0.5	+28	1.4:1	BNC (F)	240/110 V AC	3.5	200x120x90	WR-06, UG-387/U-M

Specification Definitions

Nominal value (nom.) – ensured by design, not tested. **Measured value (min, max)** – expected and warranted product performance obtained from the actual measurements of product sample. **Non-traceable measured value (n. trc. meas.)** – expected product performance obtained from the actual measurements of a product sample by means of using Farran's own equipment and methods. Traceable only to Farran laboratory equipment. **Typical data (typ.)** – value that represents the product specification met over 90% of bandwidth or a mean value. **Specifications without limits** – represent the warranted product performance; with values of no or a negligible deviation from the given value and as such have a secondary impact on the product performance.

8. Typical Performance

FBC/WGNS-XX typical noise figure vs frequency, gain vs frequency perfomance plots are provided in this section, together with ENR tables in Section 12.1. For specific test data, refer to test data supplied along with your FBC/WGNS-XX modules. Unless otherwise stated, all perfomance data furnished here has been obtained from in-house measurements at standard temperature and pressure. The measurement uncertainty is ± 0.1 dB. Test results were obtained after 1 hour warm-up time.

8.1 FBC-28-FB-0001

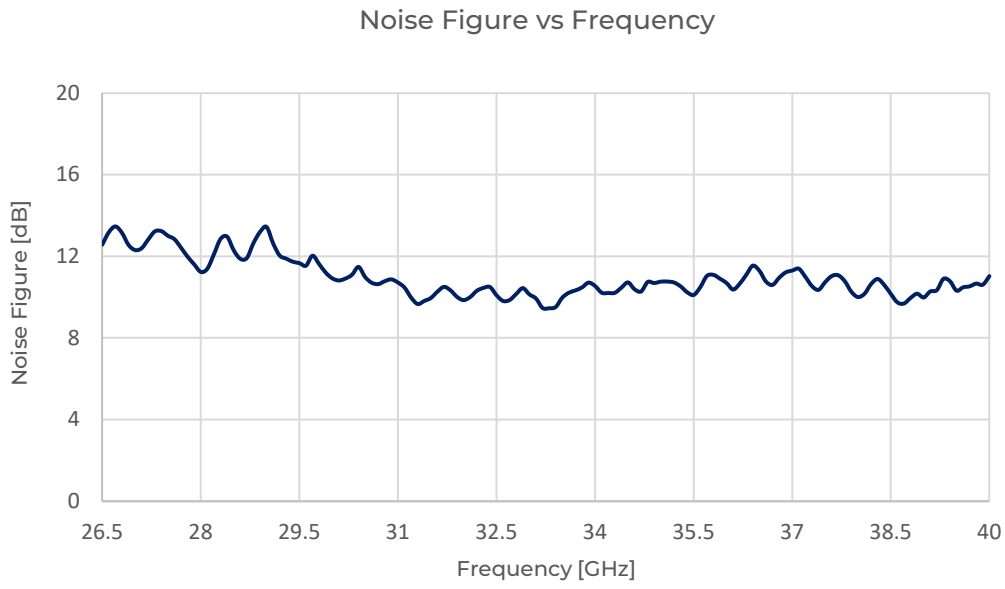

Figure 4.1(a): Typical Noise Figure vs Frequency plot

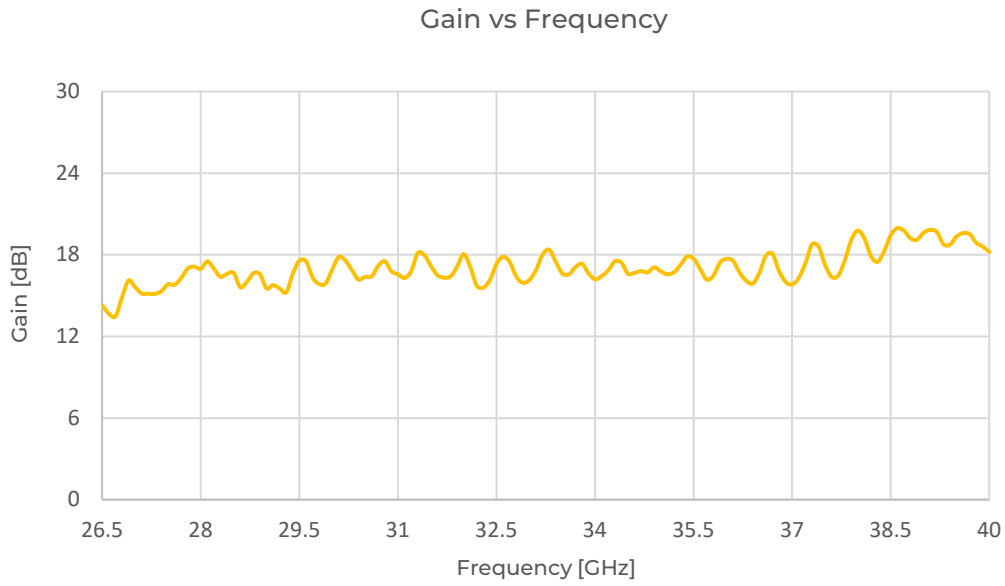

Figure 4.1(b): Typical Gain vs Frequency plot

8. Typical Performance

8.2 FBC-22-FB-0001

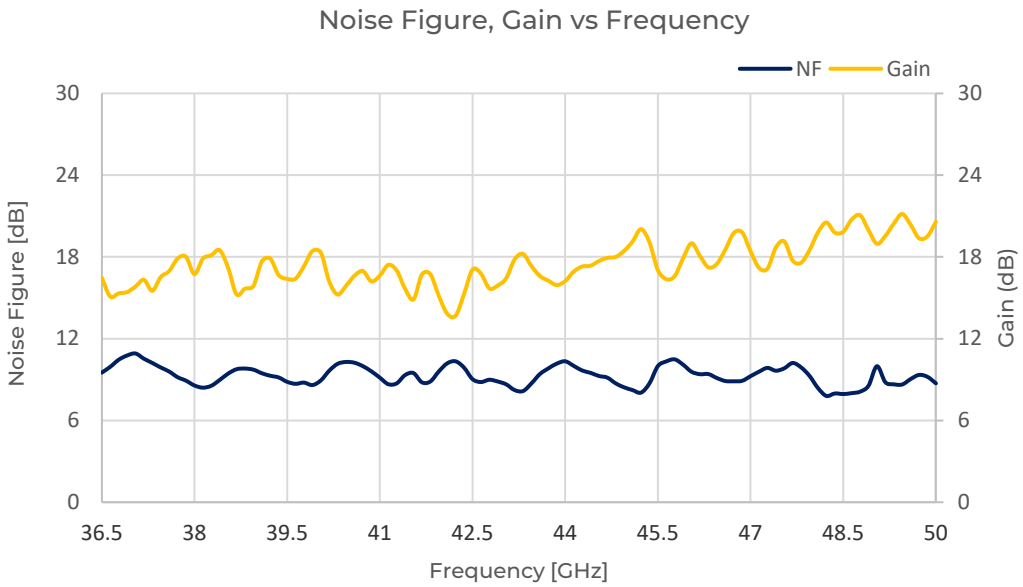

Figure 4.2(a): Typical Noise Figure, Gain vs Frequency plot

WGNS-22-0003

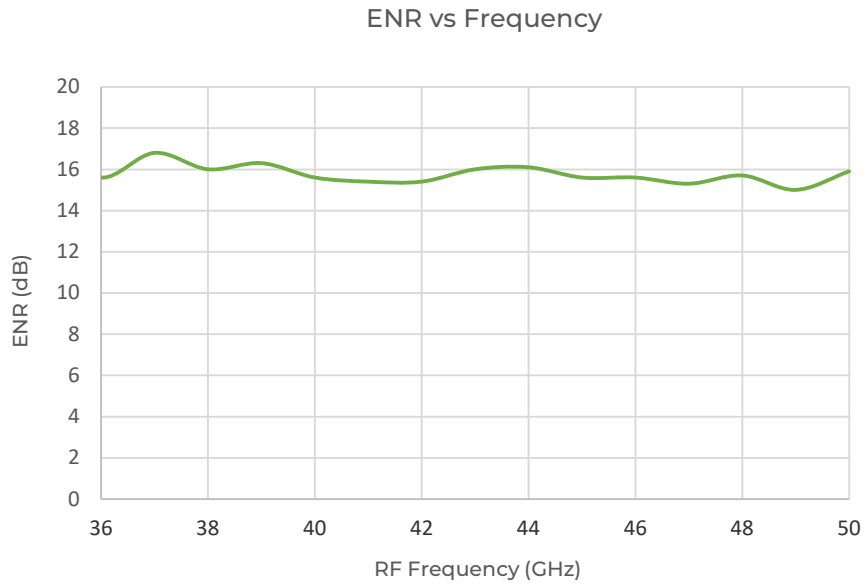

Figure 4.2(b): Typical ENR vs Frequency plot

8. Typical Performance

8.3 FBC-15-FB-0001

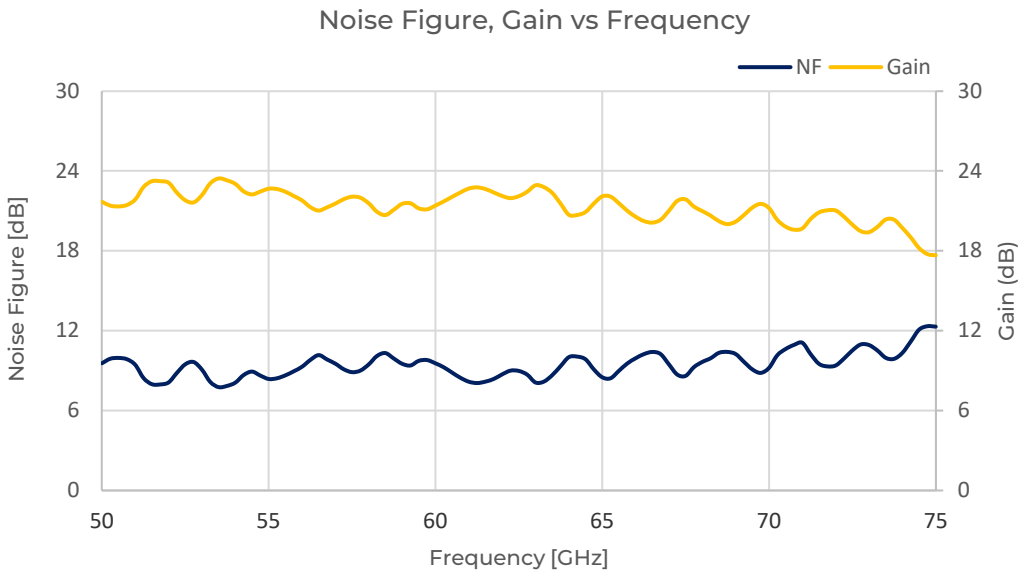

Figure 4.3(a): Typical Noise Figure, Gain vs Frequency plot

WGNS-15-0003

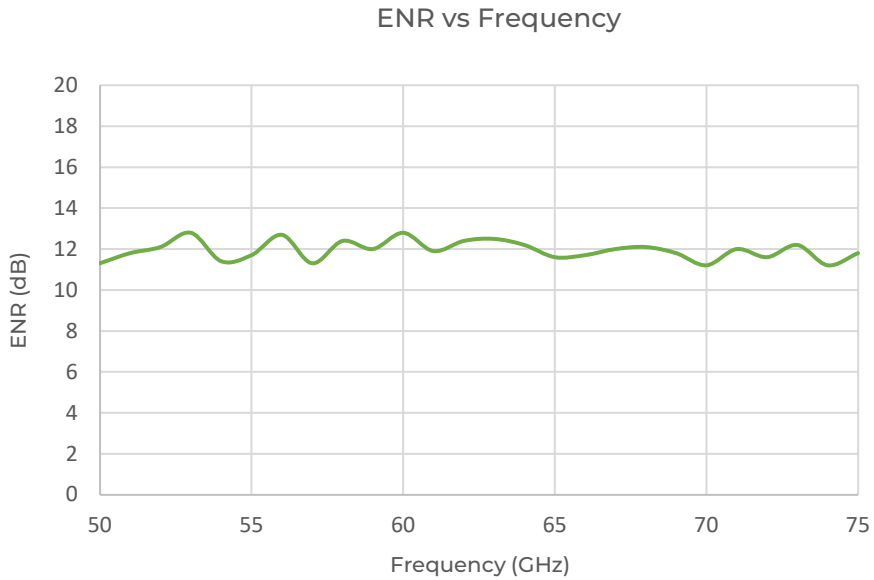

Figure 4.3(b): Typical ENR vs Frequency plot

8. Typical Performance

8.4 FBC-12-FB-0001

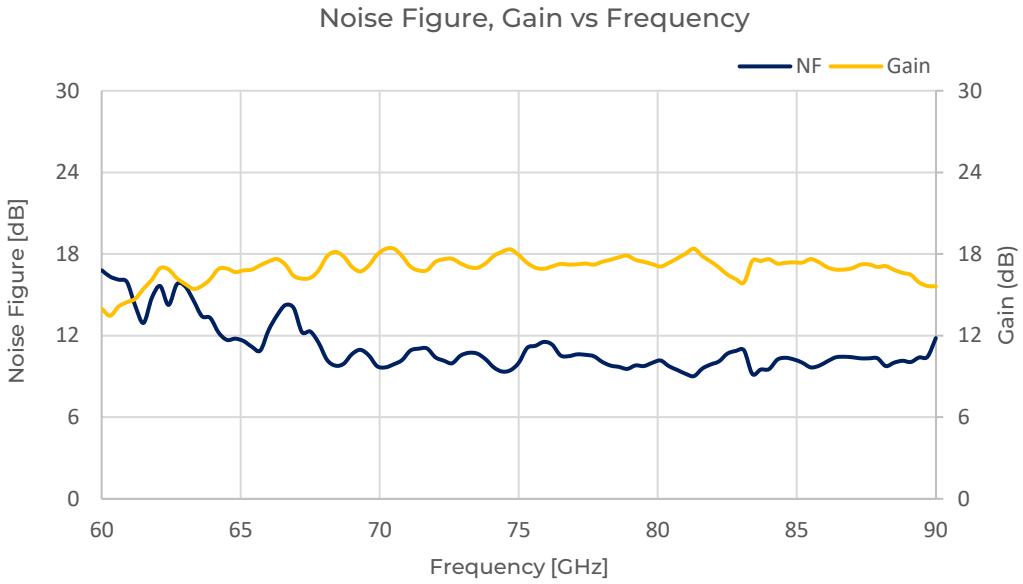

Figure 4.4(a): Typical Noise Figure, Gain vs Frequency plot

WGNS-12-0003

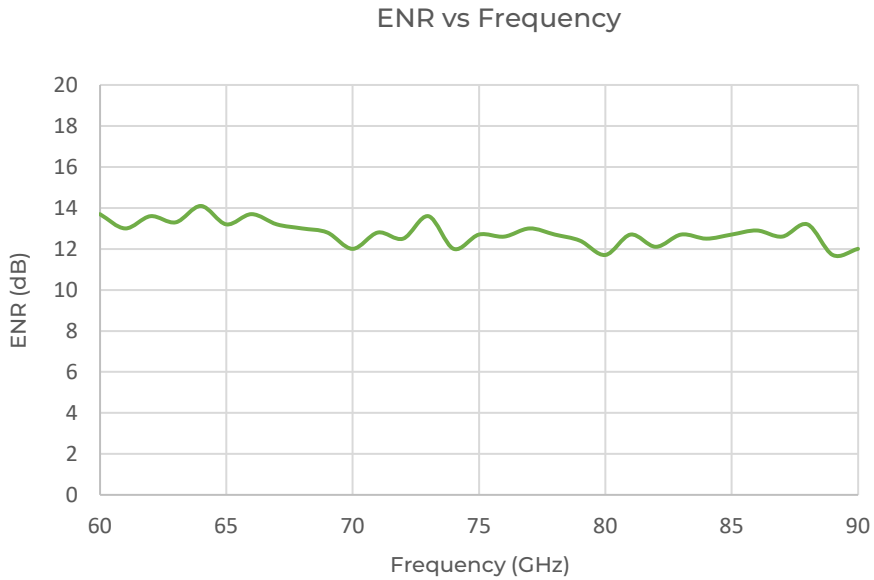

Figure 4.4(b): Typical ENR vs Frequency plot

8. Typical Performance

8.5 FBC-10-FB-0001

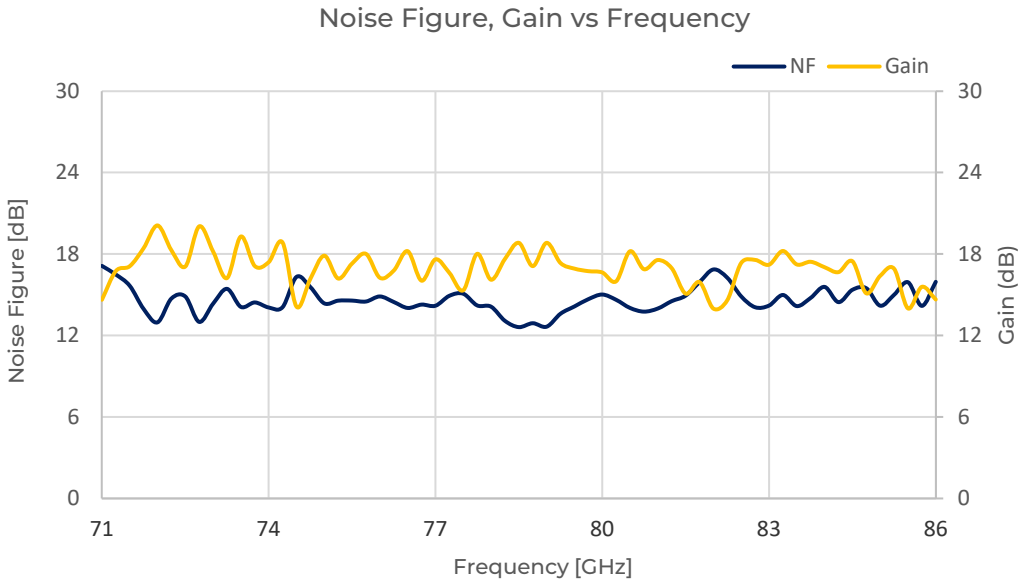

Figure 4.5(a): Typical Noise Figure, Gain vs Frequency plot

WGNS-10-0003

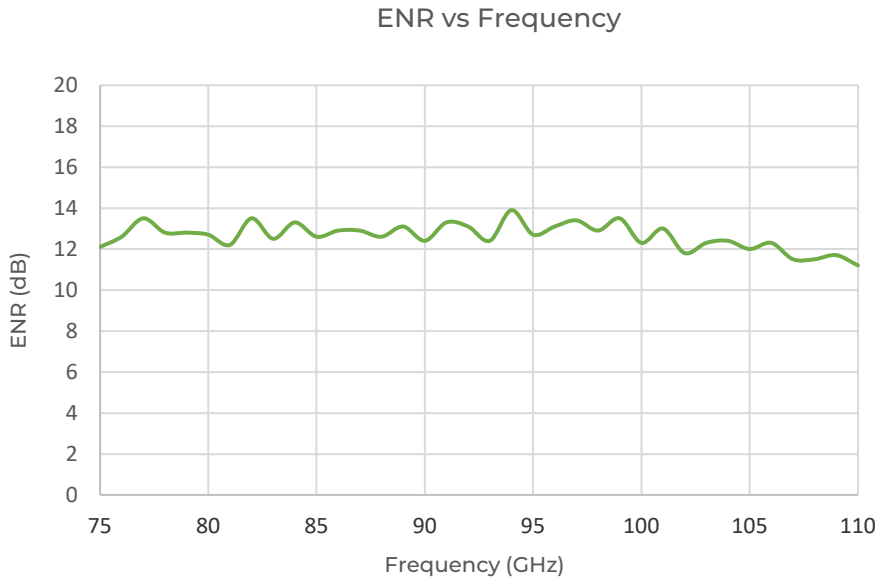

Figure 4.5(b): Typical ENR vs Frequency plot

8. Typical Performance

8.6 FBC-06-FB-0001

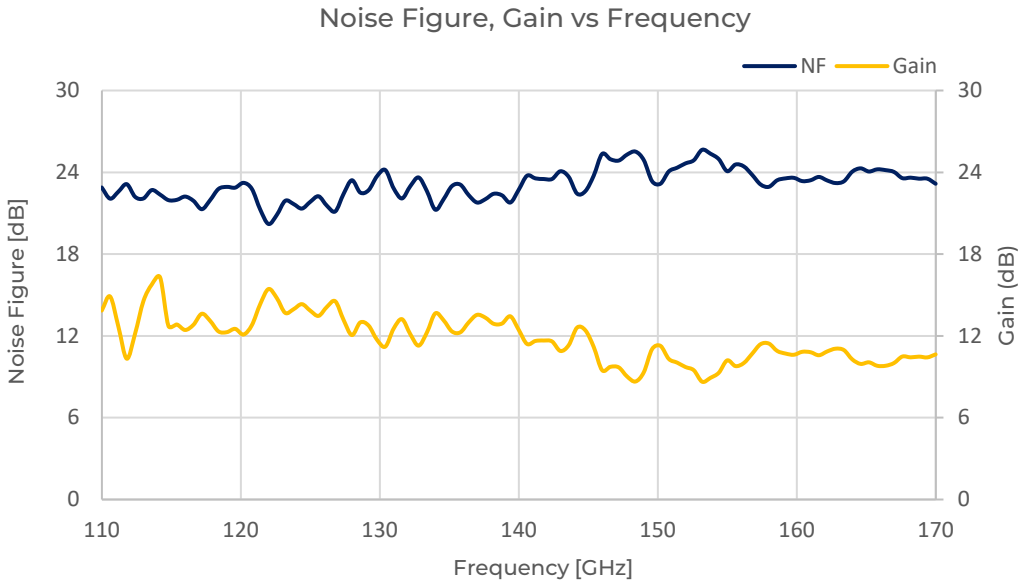

Figure 4.6(a): Typical Noise Figure, Gain vs Frequency plot

WGNS-06-0003

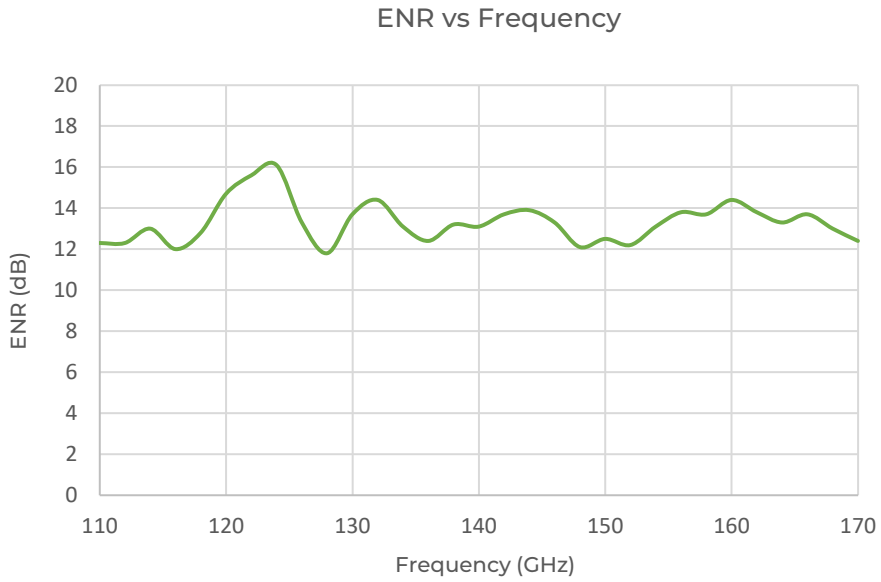

Figure 4.6(b): Typical ENR vs Frequency plot

12. Appendices

12.1 ENR Tables

Table 3. WGNS-22-0003 ENR Data

Frequency (GHz)	ENR (dB)	Frequency (GHz)	ENR (dB)	Frequency (GHz)	ENR (dB)
30	17.6	39	16.3	48	15.7
31	18.5	40	15.6	49	15
32	16.6	41	15.4	50	15.9
33	17.2	42	15.4		
34	16.1	43	16.0		
35	17.2	44	16.1		
36	15.6	45	15.6		
37	16.8	46	15.6		
38	16.0	47	15.3		

Table 4. WGNS-19-0003 ENR Data

Frequency (GHz)	ENR (dB)	Frequency (GHz)	ENR (dB)
40	12.4	51	12.0
41	11.6	52	12.7
42	11.6	53	12.7
43	12.0	54	11.6
44	11.9	55	11.9
45	13.1	56	11.8
46	12.8	57	11.4
47	12.3	58	11.4
48	12.3	59	12.0
49	11.7	60	12.6
50	12.3		

12. Appendices

12.1 ENR Tables

Table 5. WGNS-15-0003 ENR Data

Frequency (GHz)	ENR (dB)	Frequency (GHz)	ENR (dB)	Frequency (GHz)	ENR (dB)
50	11.3	59	12	68	12.1
51	11.8	60	12.8	69	11.8
52	12.1	61	11.9	70	11.2
53	12.8	62	12.4	71	12
54	11.4	63	12.5	72	11.6
55	11.7	64	12.2	73	12.2
56	12.7	65	11.6	74	11.2
57	11.3	66	11.7	75	11.8
58	12.4	67	12		

Table 6. WGNS-12-0003 ENR Data

Frequency (GHz)	ENR (dB)	Frequency (GHz)	ENR (dB)	Frequency (GHz)	ENR (dB)
60	14.2	71	13.3	81	13.2
61	13.5	72	13.0	82	12.6
62	14.1	73	14.1	83	13.2
63	13.8	74	12.5	84	13.0
64	14.6	75	13.2	85	13.2
65	13.7	76	13.1	86	13.4
66	14.2	77	13.5	87	13.1
67	13.7	78	13.2	88	13.7
68	13.5	79	12.9	89	12.2
69	13.3	80	12.2	90	12.5
70	12.5				

12. Appendices

12.1 ENR Tables

Table 7. WGNS-10-0003 ENR Data

Frequency (GHz)	ENR (dB)	Frequency (GHz)	ENR (dB)	Frequency (GHz)	ENR (dB)
75	12.1	87	12.9	99	13.5
76	12.6	88	12.6	100	12.3
77	13.5	89	13.1	101	13.0
78	12.8	90	12.4	102	11.8
79	12.8	91	13.3	103	12.3
80	12.7	92	13.1	104	12.4
81	12.2	93	12.4	105	12.0
82	13.5	94	13.9	106	12.3
83	12.5	95	12.7	107	11.5
84	13.3	96	13.1	108	11.5
85	12.6	97	13.4	109	11.7
86	12.9	98	12.9	110	11.2

Table 8. WGNS-06-0003 ENR Data

Frequency (GHz)	ENR (dB)	Frequency (GHz)	ENR (dB)	Frequency (GHz)	ENR (dB)
75	12.1	87	12.9	99	13.5
76	12.6	88	12.6	100	12.3
77	13.5	89	13.1	101	13.0
78	12.8	90	12.4	102	11.8
79	12.8	91	13.3	103	12.3
80	12.7	92	13.1	104	12.4
81	12.2	93	12.4	105	12.0
82	13.5	94	13.9	106	12.3
83	12.5	95	12.7	107	11.5
84	13.3	96	13.1	108	11.5
85	12.6	97	13.4	109	11.7
86	12.9	98	12.9	110	11.2

12. Appendices

12.2 Drawings

FBC-12-FB-0001